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Application of HCMM data to regional
geologic analysis for mineral and energy resource evaluation

Type II Progress Report
December 1981 - June 1982

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16. Abstract The experimental thermal satellite HCMM has provided unique thermal data for mapping geologic features and exploring for energy resources and mineralized areas. Using a new thermal-inertia mapping algorithm which provides greater discrimination capability than those in current use, a new geologic feature was detected in the Cabeza Prieta, Arizona, area. Initially seen on an image formed as a difference of two thermal-inertia images, it was found to be the extension of a bilaterally symmetrical aeromagnetic feature which trends northeast for a distance of at least 1200 km.					
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Figure 2. Technical Report Standard Title Page

A. Problems

We are continuing to have difficulty finding cloud-free day/night pairs of the Overthrust Belt (Montana and Idaho) and Silver City, New Mexico, quadrangles. Previously ordered scenes, based on the HCMM catalog cloudcover estimation, have not produced an acceptable day/night pair. We have just ordered six additional day/night pairs for the Overthrust Belt and one for Silver City. Of the six pairs for the Overthrust, four have 20 and 10% cloudcover. The Silver City pair has 20 and 10% cloudcover.

B. Accomplishments

A day/night pair (AA0150-09410-3; AA0150-20350-1,2) of the Colorado Plateau has been registered using our procedure and a thermal-inertia image been produced with our new algorithm. Of special interest is the Richfield quadrangle, part of the U.S. Geological Survey's ongoing CUSMAP program. Since large area, topographic-correction techniques are not operational, five profiles within the quad have been chosen for initial study. In addition we are attempting to register the thermal-inertia image to a DMA topographic base. In support of this study, a Landsat scene of this quad was processed to a color-coded image of bands 4,5, and 7.

The Cascade and the Allegheny Plateau and Appalachian Mountains investigations are proceeding more slowly. For both of these areas we have NASA registered products with residual errors which we have attempted several times to re-register. Although we are not able to get the entire scene into registration selected areas of interest have been registered.

We have applied our new thermal-inertia mapping algorithm to two day/night pairs in the Cabeza Prieta, Ariz., area and analysis of these data has lead to the discovery of a new geologic feature. The feature, initially seen on an image formed as a difference of two thermal-inertia images, was found to be the extension of a bilaterally symmetrical aeromagnetic which trends northeast for a distance of at least 1200 km. A substantial effort has been devoted to gathering information that can lead to a better understanding of the nature and cause of this feature. We have discovered numerous coincidences that provide evidence for varying degrees of geologic control along this feature both spatially and from Precambrian to Recent times. Other data that seem to bear on the problem include evidence for crustal thickening where the feature crosses from the Basin and Range to the Colorado Plateau, joint patterns, coincidence

with the northwestern edge of the Gila Gap, an apparent symmetry in Tertiary volcanics and a relationship to the spatial and temporal occurrence of mineral deposits and geothermal features. We seem to see some evidence which suggests that the feature is more permissive of vertical movement from deep in the crust near the lineament and restrictive of movement across it. As with previous lineament in the Powder River Basin, this one also has a major gold mine on it. This time it's Cripple Creek! There are a lot of other interesting parallelisms to explore in the near future - the Colorado Mineral Belt, Colorado River, Jemez lineament, the Bright Angel, and Mesa Butte fault systems of Shoemaker, and the trans-continental arch.

C. Significant Results

A feature in Cabeza Prieta, initially seen on an image formed as a difference of two thermal-inertia images was found to be the extension of a bilaterally symmetrical aeromagnetic feature which trends northeast for a distance of at least 1200 km.

D. Publications and Presentations

Ken Watson attended the Second Annual Arizona Remote Sensing Review Meeting in Tucson January 6-8, 1982, at which he presented the results of our HCMM thermal studies. He also attended the 1982 International Geoscience and Remote Sensing Symposium (IGARSS '82) in Munich June 1-4, 1982, and presented an invited paper "Geologic thermal-inertia mapping using HCMM satellite data" which is published in the proceedings.

E. Recommendations

Since very few day/night scene pairs have been processed for the mid-continent region, we would recommend keeping the IPF (Image Processing Facility) open beyond the end of the summer to provide more complete coverage of the United States.

F.